PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-369629

(43)Date of publication of application : 24.12.2002

(51)Int.Cl. A01G 9/14
A01G 13/02
B32B 27/18
C08J 5/18
C08K 3/38
C08K 9/02
C08L101/00

(21)Application number : 2001-181860

(22)Date of filing : 15.06.2001

(71)Applicant : SUMITOMO METAL MINING CO LTD

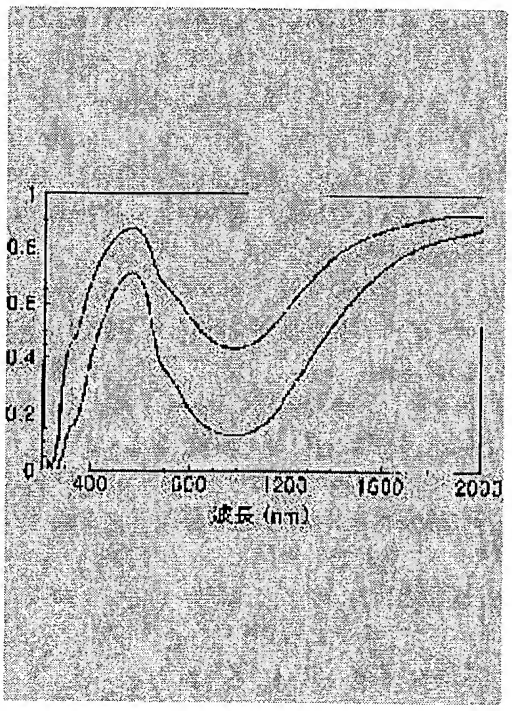
(72)Inventor : TAKEDA HIROMITSU

(54) HEAT-INSULATING MATERIAL FOR AGRICULTURAL AND HORTICULTURAL FACILITY

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a heat-insulating material for agricultural and horticultural facilities being a film-like or board-like material used for roof, outer roof material, or the like, for agricultural and horticultural houses, excellent in weather resistance, capable of transmitting visible light to keep required brightness and efficiently blocking near-infrared light and thereby having excellent heat- insulating property.

SOLUTION: This heat-insulating material for agricultural and horticultural facilities is equipped with an heat-insulating layer composed of a resin substrate in which a fine-grain heat-insulating filler is dispersed and the heat-insulating filler is at least one kind of compound selected from lanthanum hexaboride and antimony-added tin oxide. In the heat-insulating material, sunshine transmittance as an index of heat-insulating property is 10-80% and visible light transmittance is 30-90% and light transmittance in ultraviolet light area is 8-80% in 320 nm wavelength and 0-70% in 290 nm wavelength.



LEGAL STATUS

[Date of request for examination]	16.12.2003
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

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CLAIMS

[Claim(s)]
[Claim 1] Heat insulation materials for plantation art facilities characterized by being at least one sort as which was equipped with the thermal break which consists of a resin base material which the particle-like heat insulation filler distributed, and this heat insulation filler was chosen from a 6 hoe-ized lanthanum and stibiation tin oxide.
[Claim 2] Heat insulation materials for plantation art facilities according to claim 1 characterized by for light permeability being 30 - 90%, and solar radiation permeability being 10 - 80%.
[Claim 3] Heat insulation materials for plantation art facilities according to claim 1 or 2 characterized by the light transmittance whose light transmittance with a wavelength [in an ultraviolet-rays field] of 320nm is 5 - 80% and the wavelength of 290nm being 0 - 70%.
[Claim 4] Heat insulation materials for plantation art facilities according to claim 1 to 3 to which the content of the heat insulation filler in said thermal break is characterized by being 1.0 - 50 g/m2 by 0.01 - 1 g/m2 and stibiation tin oxide with a 6 hoe-ized lanthanum.
[Claim 5] Heat insulation materials for plantation art facilities according to claim 1 to 4 characterized by the resin base material of said thermal break being fluorine system resin or polyethylene terephthalate resin.
[Claim 6] Heat insulation materials for plantation art facilities according to claim 1 to 5 which are the shape of the single shape of a film, and a board which consists only of said thermal break, or are characterized by said thermal break laminating between the base materials of two sheets on the base material front face of the shape of the shape of a film, and a board.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is the materials of the shape of the shape of a film used for a roof, outer wall material, etc. of the house for plantation arts, and a board, and relates to the heat insulation materials for facilities for plantation arts which have especially adiabatic efficiency.
[0002]
[Description of the Prior Art] Conventionally, generally the resin film and the resin plate are used for plantation art facilities including the house for the object for agriculture, or horticulture as a roof, outer wall material, etc. As the typical quality of the material, generally vinyl chloride resin, polyethylene resin, polyester resin, a fluororesin, etc. are used, and, recently, the fluororesin excellent in weatherability, the light transmission nature of an ultraviolet-rays field, etc. also attracts attention.
[0003] As for the materials used for a roof, outer wall material, etc. of these plantation art facility, the most is designed for the purpose of incubation. However, it needed to open and close a part of roof and outer wall material, and since the purpose of incubation avoided that the temperature in a facility becomes high too much in addition to winter while it is mostly attained by cutoff of the open air, it needed to perform temperature control.
[0004] Therefore, although the demand of materials equipped with adiathermic is increasing from the plantation art pursuer as materials used for a roof, outer wall material, etc. of a plantation art facility, most materials of the shape of the shape of a film in consideration of this and a board are the present condition which is not offered.
[0005]
[Problem(s) to be Solved by the Invention] The proposal which adds to resin the coloring matter which has near infrared ray absorptance as a member for OA equipment, and gives a heat insulation property is made in JP,9-330612,A. Moreover, the heat insulation resin which made the copper ion contain is proposed by JP,6-118228,A as a light filter.
[0006] However, when coloring matter and copper which were proposed by the above-mentioned official report are included in resin, and it is used as materials for heat insulation, and exposed to the outdoors for a long period of time, the fault that adiabatic efficiency deteriorates is [since weatherability is low and degradation by ultraviolet rays, heat, etc. tends to take place,] at an early stage. Moreover, in the case of coloring matter, since it is easy to generate bleeding, there is also a fault that a resin front face milks and light transmission nature falls extremely. Therefore, the especially prolonged use as materials for plantation art facilities was difficult for the resin film containing coloring matter or a copper ion etc.
[0007] This invention is the materials of the shape of the shape of a film used for a roof, outer wall material, etc. of the house for plantation arts in view of such a conventional situation, and a board, and it aims at offering the heat insulation materials for plantation art facilities equipped with adiathermic by covering near-infrared light efficiently, penetrating the light and holding required brightness while excelling in weatherability.

[0008]
It is means] in order to solve [technical problem. In order to attain the above-mentioned purpose, the heat insulation materials for plantation art facilities which this invention offers are equipped with the thermal break which consists of a resin base material which the particle-like heat insulation filler distributed, and are characterized by being at least one sort as which this heat insulation filler was chosen from a 6 hoe-ized lanthanum and stibiation tin oxide.
[0009] Moreover, light permeability is 30 - 90%, and the heat insulation materials for plantation art facilities of above-mentioned this invention are characterized by solar radiation permeability being at 10 - 80%. Furthermore, it is characterized by the light transmittance whose light transmittance with a wavelength [in an ultraviolet-rays field] of 320nm is 5 - 80% and the wavelength of 290nm being 0 - 70%.
[0010] In the heat insulation materials for plantation art facilities of above-mentioned this invention, it is desirable that the content of the heat insulation filler in said thermal break is 1.0 - 50 g/m2 with a 6 hoe-ized lanthanum in 0.01-1g/m2, and stibiation tin oxide. Moreover, as for the resin base material of said thermal break, it is desirable that they are fluorine system resin or polyethylene terephthalate resin.
[0011] The heat insulation materials for plantation art facilities of above-mentioned this invention are the shape of the single shape of a film, and a board which consists only of said thermal break, or are characterized by said thermal break laminating between the base materials of two sheets on the base material front face of the shape of the shape of a film, and a board.
[0012] In addition, the value of each light transmittance described above in this invention is JIS about the film for construction windowpanes. A It measures and computes based on 5759 (1998) (light source: A light). However, the test sample was not stuck on glass but used the thing of the shape of the shape of a film, and a board as it was. Moreover, solar radiation permeability is permeability to the light of a 350-2100nm wavelength region, and was used as an index by which it evaluates adiathermic [over the sunrays of the heat insulation materials for plantation art facilities] in this invention. Furthermore, light permeability is permeability to the light of a 380-780nm wavelength region, and was used as an index by which the brightness to human being's eyes is evaluated.
[0013]
[Embodiment of the Invention] The heat insulation materials for plantation art facilities of this invention are the shape of the shape of a film, or a board (tabular) used as a roof, outer wall material, etc. of the house for plantation arts, and are equipped with the thermal break which consists of a resin base material which distributed the particle-like heat insulation filler. Especially, as a heat insulation filler, near-infrared light is covered efficiently and two sorts are used together, using any one sort in the 6 hoe-ized lanthanum (LaB6) which can give adiathermic [outstanding], or stibiation tin oxide (it is written also as ATO below SnO2+Sb2O5:).
[0014] In the heat insulation materials for plantation art facilities, the object of heat insulation is the heat energy of sunrays. The light of the flume crack whose sunrays which arrive at surface of the earth are generally about 290-2100nm wavelength regions, among these an about 380-780nm light wavelength field maintains the brightness in a facility, and is a light required for vegetable training. Therefore, it is desirable by setting to heat insulation of sunrays, and covering or absorbing alternatively about 780-2100nm near-infrared light efficiently to choose the ingredient contributed to adiathermic.
[0015] moreover, the vegetation grown about the light of an ultraviolet-rays field -- or although there are optimal conditions according to the class of insect used for pollination etc., it is required that a 290-320nm wavelength region should generally be controlled. That is, it is because there is effectiveness which controls a noxious insect and the damage depended sick by covering the ultraviolet rays of the suitable amount of this wavelength region. The film for agriculture currently used conventionally has many which cover ultraviolet rays to some extent, and the vegetation whose species were improved on the condition does not need many ultraviolet rays. However, since pollination using the insect by a honeybee etc. may not be performed actively or it may have a bad influence on vegetable training when a great portion of ultraviolet rays are covered, it is not desirable.
[0016] Its transparency of the light of a light region is large, and the transparency spectrum of the LaB6

particle distribution film has the peak of transparency near the wavelength of 550nm as it is shown in drawing 1 . Since this transparency peak is in agreement with wavelength with the largest sensibility of people's eyes, it is advantageous to holding the brightness in a facility. Furthermore, since big absorption is near the wavelength of 1000nm, near-infrared light can be absorbed or covered efficiently, and the heat energy of sunrays can be insulated efficiently. Moreover, there is little ultraviolet absorption by LaB6, therefore it does not have a bad influence on the pollination activities by the insect, or growth of vegetation. In addition, the permeability of ultraviolet rays with a wavelength of 290-320nm can be controlled by adjusting the addition for LaB6 particle to the inside of a resin base material.

[0017] Furthermore, what is necessary is just to add [for the purpose of the inorganic material for ultraviolet-rays electric shielding, an organic material an organic inorganic composite material, for example, cerium oxide, titanium oxide, a zirconium dioxide, a zinc oxide, a benzophenone system ultraviolet ray absorbent, etc.], when control is required about the permeability of an ultraviolet-rays field. Moreover, since an electron and a hole may occur on a front face and this may degrade a resin base material owing to when ultraviolet rays are absorbed, as for the above-mentioned inorganic material system ultraviolet absorption material, what has carried out coat processing of the front face is desirable. As surface lining processing, although various coupling agents, a surface treatment agent, sol gel silicate, etc. are typical, if the effectiveness of preventing degradation of resin is acquired, an approach will not be asked.

[0018] Thus, the heat insulation materials of this invention which makes LaB6 particle a heat insulation filler have a heat insulation property by absorbing or covering the near infrared ray field of sunrays efficiently, and to coincidence, centering on near the wavelength of 550nm, since the transparency property of a light field is good, they can hold the brightness in a facility enough. And the description which penetrates ultraviolet rays with a wavelength of 320nm or less is in a desirable thing, the honeybee which contributes to pollination by this can work actively, and the stable harvest can be expected.

[0019] Moreover, the transparency spectrum of the ATO particle distribution film is shown in drawing 2 . Since it has absorption in a near infrared region with a wavelength of 800nm or more at coincidence in being able to keep the inside of a facility bright, since a flat large and transparency profile is shown in a light region with a wavelength of 380-780nm and there is almost no absorption of a light region so that drawing 2 may show, high adiabatic efficiency is acquired. Furthermore, since the transparency in an ultraviolet-rays field with a wavelength of 290-320nm is also obtained, there is almost no bad influence also in pollination of a honeybee etc.

[0020] In addition, also in this ATO, in order to control the permeability of an ultraviolet-rays field, it is the same as that of the case of the above LaB6 that surface lining processing is desirable for that the inorganic material for ultraviolet-rays electric shielding, an organic material, and an organic inorganic composite material can be added and the degradation prevention of a resin base material about inorganic material system ultraviolet absorption material.

[0021] Thus, they also have transparency of an ultraviolet-rays field while they can hold the brightness in a facility enough and have high adiabatic efficiency by absorption or electric shielding of a near infrared ray field, since the heat insulation materials of this invention which makes an ATO particle a heat insulation filler are transparent and colorless in a light field.

[0022] Moreover, it is also possible to use LaB6 and ATO together as a heat insulation filler, and the heat insulation materials which have a still more effective heat insulation property at this time are obtained. Namely, LaB6 has big absorption near the wavelength of 1000nm, and, on the other hand, as for ATO, absorption increases gradually on the wavelength of 800nm or more as shown in drawing 1 and drawing 2 . therefore, the thing for which both particles are distributed in a resin base material -- either -- compared with the case where only one of the two is used, absorption or electric shielding of a near-infrared region becomes still more greatly and efficient, and can acquire a still higher heat insulation property.

[0023] Therefore, the heat insulation materials for plantation art facilities of this invention which makes LaB6 and/or an ATO particle a heat insulation filler have the three penetrable properties of an ultraviolet

region at coincidence in the permeability of the light region for holding desirable brightness, the absorptivity of the near-infrared region which gives high adiabatic efficiency, and a list, and are very useful as roofs, outer wall material, etc. of a plantation art facility, such as a house. And since these heat insulation filler is an inorganic material, high weatherability is obtained as compared with an organic system ingredient, and it is excellent especially as heat insulation materials for plantation art facilities usually used outdoors.

[0024] With the heat insulation materials for plantation art facilities of this this invention, it is important that the balance of the permeability of a light region and the absorptivity of a near-infrared region is optically good. That is, as for light permeability, it is desirable that it is 30 - 90%, and it is still more desirable that it is 60 - 90%. As for solar radiation permeability, to coincidence, it is desirable that it is 10 - 80%, and it is still more desirable that it is 10 - 70%. Moreover, about the light transmittance of an ultraviolet-rays field, it is desirable that light transmittance with a wavelength of 320nm comes out 5 to 80%, and it is desirable that the light transmittance which is the wavelength of 290nm is 0 - 70%.

[0025] The particle diameter (floc is also included) of the heat insulation filler of the shape of an above-mentioned particle can be suitably chosen by whether a scattering effect is used. For example, it becomes small [dispersion of sunrays] 200nm or less, when it is especially 100nm or less very [the particle diameter of the heat insulation filler distributed in the resin base material of a thermal break], and sunrays come to arrive at vegetation or the ground directly. Furthermore, since most light of a light field is not scattered about, it is easy to observe the situation in facilities, such as a house, from the outside, and an outside circumference can also be checked from the inside of a facility.

[0026] On the other hand, dispersion of sunrays is large in the particle diameter of the particle distributed in the thermal break being that [200nm or more], the light which arrives at the vegetation and the ground in a facility becomes homogeneity, and its effect which shadows, such as a skeleton of a house, have on vegetation decreases. However, since the light of a light field is also scattered on coincidence, even if it can hold the inside of a facility to required brightness, it becomes difficult to observe the situation in a facility from the outside.

[0027] When various **** make particle diameter small, there are approaches, such as a ball mill, a sand mill, sonication, collision grinding, and pH control, and according to applications, such as a wet method or dry process, the approach of controlling the particle diameter of LaB6 and ATO chooses these approaches, and can carry out the thing of them. When distributing a particle with a particle diameter of 200nm or less especially, it can be made to distribute in the condition of having been stabilized when various kinds of coupling agents, the dispersant, and the surfactant were used, and the particulate material after processing can also be held to stability.

[0028] The heat insulation materials for plantation art facilities of this invention containing the thermal break of a resin base material which distributed the particle of the above LaB6 and/or ATO have the shape of the mode currently used for the house for agriculture etc. as a roof or outer wall material from the former, the shape of i.e., a film, and a board (tabular). Although it is the shape of the single shape of a film, and a board which generally consists only of the above-mentioned thermal break, you may be the thing of the laminated structure which laminated the above-mentioned thermal break of at least one layer between the base materials of two sheets on the base material front face of the shape of the shape of a film which consists of resin produced separately, glass, etc., and a board.

[0029] In the heat insulation materials for plantation art facilities which have such various kinds of gestalten, formation of the thermal break scours to resin LaB6 and/or the ATO particle which are a heat insulation filler, and can be performed by fabricating this. When scouring to resin, it is possible to control the particle diameter of a particle by the above-mentioned approach if needed. Moreover, since the particle of LaB6 and ATO is thermally stable, it can be kneaded at the temperature near the melting point of resin (before or after 200-300 degrees C).

[0030] After pelletizing the resin which kneaded LaB6 and/or an ATO particle, it is fabricated the shape of a film, and in the shape of a board by the extrusion-molding method, the inflation-molding method, the solution casting method, etc. In addition, although the film at this time or the thickness of a board can be suitably set up according to the purpose of use, generally it is preferably desirable [in the case of

the range of 20-500 micrometers, and a board] in the case of a film to consider as the range of 2-15mm 10-1000 micrometers. Moreover, when the operability at the time of kneading and shaping etc. is taken into consideration, generally 50 or less % of the weight is desirable [the amount of LaB6 kneaded in resin, and/or an ATO particle] to resin.

[0031] The content of the heat insulation filler in a thermal break is changeable according to the optical property and heat insulation property which are made into the thickness of a thermal break, the thickness of the base material laminated if needed, and the purpose. For example, since LaB6 has the high adiabatic efficiency in a unit weight, the adiabatic efficiency at 0.01g or more with the content effective [1m of thermal breaks] per two is acquired. Moreover, in 1 g/m2, it is possible to absorb or cover the heat energy of about 90% of sunrays, and if sufficient effectiveness for heat insulation of summer is acquired and the heat insulation effect of a winter season is taken into consideration, the addition beyond this is not desirable. Therefore, as for the content of LaB6, it is desirable to consider as the range of 0.01-1g/m2.

[0032] Moreover, when a heat insulation filler is ATO, a thermal break is about 3g per two in content 1m, and it is possible to absorb or cover the heat energy of about 30% of sunrays. Generally, in less than two 1.0 g/m, since cost will become high and processing to the materials for heat insulation will become difficult further if adiabatic efficiency exceeds 50 g/m2 rather than is [and] enough, it is not desirable. Therefore, as for the content of ATO, it is desirable that it is the range of 1.0 - 50 g/m2.

[0033] Especially the resin used as the matrix of a thermal break is not limited, and is selectable according to an application. For example, by low cost besides the polyethylene resin currently used for the house etc. from the former, polyester resin, and soft polyvinylchloride resin, transparency is high and polyethylene terephthalate (PET) resin, acrylic resin, polyamide resin, vinyl chloride resin, polycarbonate resin, olefine resin, an epoxy resin, polyimide resin, etc. are mentioned as large resin of versatility. Although especially PET has the description in the permeability of an ultraviolet-rays field and near the wavelength of 320nm is penetrated, since near the wavelength of 290nm is hardly penetrated, it is a resin ingredient desirable when controlling the permeability of an ultraviolet-rays field.

[0034] Moreover, if weatherability, diactinism, etc. are taken into consideration, fluorine system resin is effective. That what is necessary is just resin which contains a fluorine in the molecular structure, 1 2 fluoride [3 fluoride / polytetrafluoroethylene resin and ethylene resin / and ethylene resin], ethylene resin, etc. fluoride may be mentioned, and fluorine system resin may be such mixture here.

[0035] Specifically Furthermore, a polytetrafluoroethylene (PTFE) and tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer (PFA), A tetrafluoroethylene-hexafluoropropylene copolymer (FEP), A tetrafluoroethylene-hexafluoropropylene-perfluoroalkyl vinyl ether copolymer (EPE), A tetrafluoroethylene-ethylene copolymer (ETEF), polychlorotrifluoroethylene resin (CPTFE), A chlorotrifluoroethylene-ethylene copolymer (ECTFE), poly vinylidene fluoride (PVDF), polyvinyl fluoride (PVF), etc. are mentioned. It is possible for various marketing of these fluorine system resin and the various conversion articles of those, or the composite article to be carried out, and to carry out selection use according to the property to need.

[0036] Moreover, the thermal break containing the case 6, for example, LaB, and/or ATO particle of the heat insulation materials for plantation art facilities of the laminated structure mentioned above can be coated on the front face of one of the two of the base material which consists of a film, an existing board or an existing glass plate made of resin, etc., or both, and can be manufactured. The bar coat method, the GURABIYA coat method, a spray coating method, a dip coating method, etc. can be used for the coating approach that what is necessary is just to be able to form a uniform paint film in a base material front face.

[0037] When forming a thermal break with the above-mentioned coating method, it is desirable to use ultraviolet-rays hardening resin as the resin holding a particle or a binder. That is, it is possible to mix the heat insulation filler of suitable particle diameter with ultraviolet-rays hardening resin, to irradiate ultraviolet rays and to stiffen them, after [liquefied] having been, carrying out, considering as the shape of a paste, coating a base material front face and evaporating a solvent. Furthermore, if the resin of

rebound ace court nature is used as ultraviolet-rays hardening resin, a thermal break with high surface antifriction reinforcement is obtained, and even if dust etc. collides, the surface characteristic to which a blemish cannot be attached easily can be given. At this time, abrasion strength can be further raised the inorganic binder of SiO2 grade, and by adding SiO2 particle etc.

[0038] Moreover, when coating a thermal break like the above, it is desirable to process a base material front face beforehand and to raise the adhesion force with a thermal break. By this surface preparation, the wettability on the front face of a base material is improved by coincidence, it prevents flipping at the time of coating, and it becomes easy to obtain uniform coating. It is desirable to perform surface treatment to especially the base material that consists of fluorine system resin. As the surface-preparation approach, corona treatment, spatter processing, primer coating processing, etc. are known well.

[0039] Furthermore, when a thermal break is laminated and it forms the heat insulation materials for plantation art facilities between the two above-mentioned base materials, it can also use as the resin holding the particle of a heat insulation filler, or a binder, the resin, for example, the vinyl chloride copolymer etc., for a lamination etc. Furthermore, it is also possible to coat the roof of the existing facility for plantation arts and the front face of outer wall material by mixing the particle of a heat insulation filler with the resin of room-temperature-setting nature, and to give a heat insulation property afterwards by it again. Thus, it is possible by selecting a resin base material according to the purpose and an application to give a heat insulation property to a base material.

[0040]

[Example] The example 1LaB6 particle (specific-surface-area 30m2/g) 20 weight section, the toluene 75 weight section, and the dispersant 5 weight section were mixed, and dispersion liquid A with a mean-dispersion particle diameter of 80nm were obtained. It considered as the powder A of LaB6 which removed and carried out distributed processing of the solvent component at 50 degrees C using the vacuum dryer from these dispersion liquid A. In addition, mean-dispersion particle diameter was measured with the measuring device (Otsuka electronic incorporated company (**): ELS-800) which used dynamic light scattering, and was made into the average.

[0041] 8.7kg of ETFE (tetrafluoroethylene-ethylene copolymer) resin was blended dryly with powder A0.01kg of this LaB6 with V blender. Then, sealing mixing was fully carried out at 320 degrees C which is near the melting temperature of ETFE resin, extrusion molding of the mixture was carried out at 320 degrees C, and the film with a thickness of about 50 micrometers was formed. The content of LaB6 particle in this film is equivalent to 0.13 g/m2.

[0042] About the heat insulation materials of the shape of an acquired film, it is JIS. A Optical measurement was performed based on 5759 (1998) (light source: A light), and it asked for light permeability, solar radiation permeability, and the light transmittance in an ultraviolet-rays field. However, the test sample was not stuck on glass but used the film itself. Moreover, it is JIS in order to evaluate transparency. K The haze value was measured based on 7105. It is so highly transparent that a haze value is low.

[0043] Consequently, it turned out that the light permeability of the above-mentioned film-like heat insulation materials can cover the direct incident light of sunrays 50%, and has high adiabatic efficiency at the same time 70% and solar radiation permeability are 50% and it penetrates the light of a light field enough. Moreover, the permeability of an ultraviolet-rays field was the range where it is 26% and a honeybee etc. can be pollinated sufficiently actively by 18% and 320nm on the wavelength of 290nm. Furthermore, a haze value is 4.2% and has the high transparency which can check an internal situation enough also from the exterior.

[0044] In the example of comparison 1 above-mentioned example 1, LaB6 particle of a heat insulation filler was not added, but extrusion molding of the ETFE resin was carried out, and the film with a thickness of about 50 micrometers was formed. Although the 10 sections of light of a light field are penetrated at 89%, it is 89%, and solar radiation permeability can also cover the direct incident light of sunrays only about 11%, but, as for the light permeability of the obtained film, is understood that adiabatic efficiency is low. In addition, the permeability of an ultraviolet-rays field was 88% in 82% and

320nm on the wavelength of 290nm, and the haze value was 4.0%.
[0045] 8.7kg of ETFE resin was blended dryly with powder A0.005kg of LaB6 in the example 2 above-mentioned example 1 with V blender. Then, sealing mixing was fully performed like the example 1 at 320 degrees C which is near the melting temperature of ETFE resin, extrusion molding of the mixture was carried out at 320 degrees C, and the film with a thickness of about 50 micrometers was formed. The content of LaB6 particle in this film is equivalent to 0.05 g/m2.
[0046] When the heat insulation materials of the shape of an acquired film were similarly estimated as the example 1, it turned out that light permeability can cover the direct incident light of sunrays about 35%, and has high adiabatic efficiency at the same time 80% and solar radiation permeability are 65% and it penetrates the light of a light field enough. The permeability of an ultraviolet-rays field was the range where it is 43% and a honeybee etc. can be pollinated sufficiently actively by 34% and 320nm on the wavelength of 290nm. Furthermore, a haze value is 4.1%, the transparency of a value is high and an internal situation can check it enough also from the exterior.
[0047] In the example 3 above-mentioned example 2, PET (polyethylene terephthalate) resin was used instead of ETFE resin, and the film was produced by the same approach as an example 2 except having made heating temperature into the temperature (about 300 degrees C) which PET softens enough. The content of LaB6 particle in this film is equivalent to 0.05 g/m2 as well as an example 2.
[0048] When the heat insulation materials of the shape of an acquired film are similarly estimated as an example 1, it turns out that light permeability has covered the direct incident light of sunrays about 35%, and has high adiabatic efficiency at the same time 79% and solar radiation permeability are 65% and it penetrates the light of a light field enough. Moreover, it is the effect of the PET which is a resin base material that the permeability of an ultraviolet-rays field is 35% in 0% and 320nm on the wavelength of 290nm, and the permeability in 290nm is 0%. Furthermore, a haze value is 2.5% and is understood that transparency is very high.
[0049] In the example of comparison 2 above-mentioned example 3, LaB6 particle of a heat insulation filler was not added, but extrusion molding of the PET was carried out, and the film with a thickness of about 50 micrometers was formed. Although the light of a light field is enough penetrated at 88%, it is 88%, and solar radiation permeability can also cover the direct incident light of sunrays only about 12%, but, as for the light permeability of the obtained film, is understood that adiabatic efficiency is low. Moreover, the permeability of an ultraviolet-rays field was 52% in 0% and 320nm on the wavelength of 290nm, and the haze value was 1.0%.
[0050] The example 4ATO particle (specific-surface-area 50m2/g) 20 weight section, the toluene 75 weight section, and the dispersant 5 weight section were mixed, and dispersion liquid B with a mean-dispersion particle diameter of 75nm were obtained. It considered as the powder B of ATO which removed and carried out distributed processing of the solvent component at 50 degrees C using the vacuum dryer from these dispersion liquid B.
[0051] After blending dryly powder B0.4kg and 8.65kg of ETFE resin of this ATO with V blender, sealing mixing was fully performed at 320 degrees C which is the melting temperature of ETFE resin, extrusion molding of this mixture was carried out at 320 degrees C, and the film with a thickness of about 50 micrometers was formed. The content of the ATO particle in this film is equivalent to 4.5 g/m2.
[0052] When the heat insulation materials of the shape of an acquired film are similarly estimated as an example 1, it turns out that light permeability can cover the direct incident light of sunrays about 37%, and has high adiabatic efficiency at the same time 79% and solar radiation permeability are 63% and it is penetrating the 10 sections of light of a light field. Moreover, by 3.4% and 320nm, the permeability of an ultraviolet-rays field is 30.0% on the wavelength of 290nm, and it turns out that pollination of a honeybee etc. can carry out sufficiently actively. Furthermore, a haze value is 4.5% and has the transparency which an internal situation can check enough also from the exterior.
[0053] 8.65kg of ETFE resin was blended dryly with powder B0.2kg of ATO of the example 5 above-mentioned example 4 with V blender. Then, sealing mixing was fully performed near 320 degree C which is the melting temperature of EFTE resin, extrusion molding of the mixture was carried out at 320

degrees C, and it formed in about 50 micrometers in thickness at the film. The content of the ATO particle of this film is equivalent to 2.0 g/m2.
[0054] When the heat insulation materials of the shape of an acquired film are similarly estimated as an example 1, it turns out that light permeability has covered the direct incident light of sunrays about 27%, and has high adiabatic efficiency at the same time 84% and solar radiation permeability are 73% and it is penetrating the light of a light field enough. Moreover, the permeability of an ultraviolet-rays field is the range by which it is 49% and a honeybee etc. can be pollinated sufficiently actively by 15% and 320nm on the wavelength of 290nm. Furthermore, a haze value is 4.2%, the transparency of a value is high and an internal situation can check it enough also from the exterior.
[0055] The dispersion-liquid A10 weight section of LaB6 particle in example 6 example 1 was mixed with the ultraviolet-rays hardening resin (100% of solid content) 100 weight section for rebound ace courts. After having used the bar coating machine, having formed membranes on the PET film (50 micrometers in thickness) which carried out surface corona treatment of the obtained liquid beforehand, drying this for 30 seconds at 100 degrees C and evaporating a solvent, it was made to harden with a high-pressure mercury lamp, and the thermal break was formed on the PET film.
[0056] The heat insulation materials of the shape of an acquired film have the two-layer laminated structure which consisted of a thermal break which LaB6 particle distributed in the ultraviolet-rays hardening resin for rebound ace courts, and a PET film which is the base material which this thermal break laminated. Moreover, the thickness of the thermal break of this film is about 2 micrometers, and the content of LaB6 particle is equivalent to 0.08 g/m2.
[0057] When the heat insulation materials of the shape of an acquired film are similarly estimated as an example 1, it turns out that light permeability has covered the direct incident light of sunrays about 43%, and has high adiabatic efficiency at the same time 75% and solar radiation permeability are 57% and it is penetrating the light of a light field enough. Moreover, it is the effect of a PET base material that the permeability of an ultraviolet-rays field is 22% in 0% and 320nm on the wavelength of 290nm, and the permeability in 290nm is 0%. Furthermore, a haze value is 1.0%, the transparency of a value is very high and an internal situation can check it clearly also from the exterior.
[0058]
[Effect of the Invention] While according to this invention it excels in weatherability and the light of a light region required for an activity inside or vegetable training is penetrated enough, near-infrared light can be absorbed or intercepted efficiently, and the heat insulation materials for plantation art facilities of the shape of the shape of a film equipped with adiathermic [high] and a board can be offered. And they can make insects, such as a honeybee required for pollination, work sufficiently actively while they control generating of a pest, since the heat insulation materials for plantation art facilities of this invention can penetrate ultraviolet rays moderately or can control the transparency.

[Translation done.]